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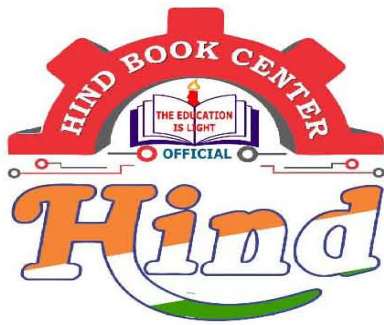
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INDUSTRIAL ENGINEERING

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(Saurabh.Pande.35)

- Saurabh Pande Sir

- Introduction & BEA
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- Sequencing
- PERT- CPM **
- Forecasting **
- Line Balancing
- Queuing
- Linear Programming (Graphical, simplex, Transportation, Assignment)*
- MRP & JIT
- PPC & Plant Layout
- Lean Manufacturing

GATE → 6 marks
(4 to 8 marks)

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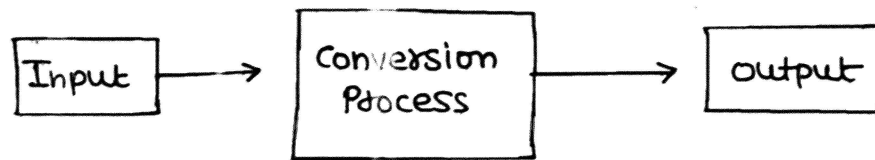
Hima & Gupta
or
Kanti Swarup
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ND Vohra

→ For
OR

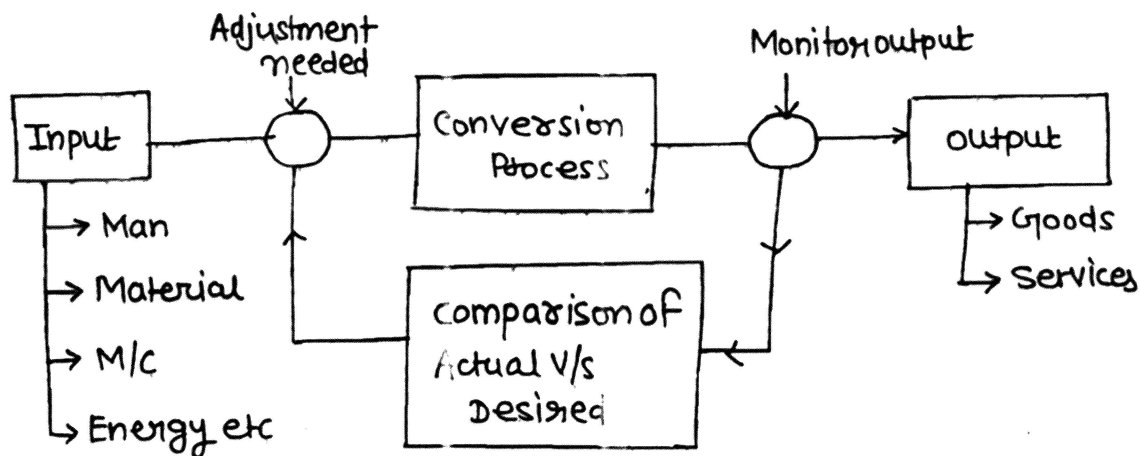
O.P. Khanna
or
Mahajan
or
Ravi Shankar

→ IE

Production: → It is a step by step value addition process of converting one form of material into another form to increase a utility of the product for the user.



Production System: → It is an organised and effective process of converting Raw Material into Final Product with a feedback loop.



Productivity: →
$$\text{Productivity} = \frac{\text{Output}}{\text{Input}}$$

It is a quantitative ratio b/w what we produce and what we use as resources to produce them. Every organization always wants to increase productivity by applying new technique and method.

Industrial Engineer: →

Industrial Engineer will be concerned with design, installation and improvement of production system, his objective is to eliminate unproductive operations from the production system in order to increase productivity.

Production Manager: → Production manager is concerned with planning, controlling and directing the day to day working of production system. his objective is to produce goods & services of high quality and quantity at predetermined time and cost.

• Cost in Production: →

1. Prime or direct Cost = Direct Material + Direct Labour + Direct Expenses

2. Factory overhead
or
Factory Expenses = Indirect Material + Indirect Labour + Indirect Expenses

| | | |
|----------------------------|-------------|-------------------|
| → cutting fluid, | → Watchman, | → Land, Rent |
| → Grease, Lubricants, | Supervisor, | Telephone |
| → Cotton, Jute, Stationary | Higher | bills, |
| items etc | officers | facility |
| | etc. | development, |
| | | electricity bills |
| | | etc. |

3. Factory Cost = Prime Cost + Factory overhead.

4. Total Cost = Factory Cost + Marketing, Advertising, transportation cost etc.

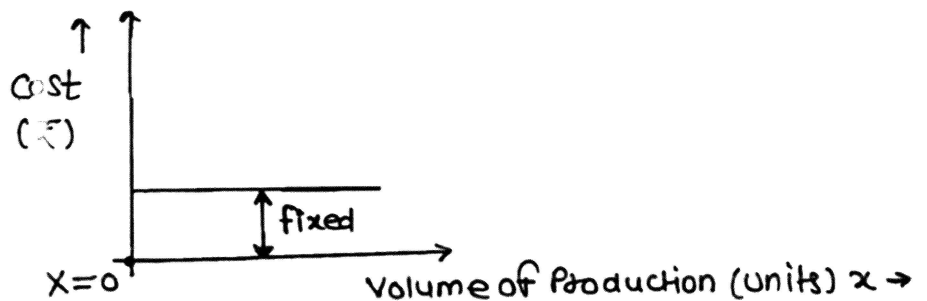
5. Selling Cost = Total Cost + Profit

BREAK EVEN ANALYSIS (BEA) →

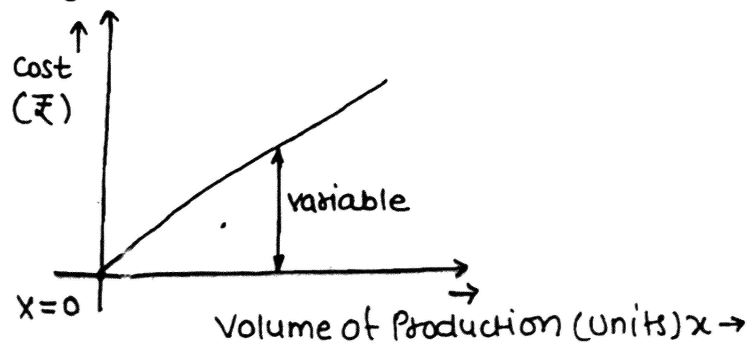
Total Cost, Selling Cost, Volume of Production

It is an important tool used by Production manager to Analysis the Potential Profit or loss Possible in future

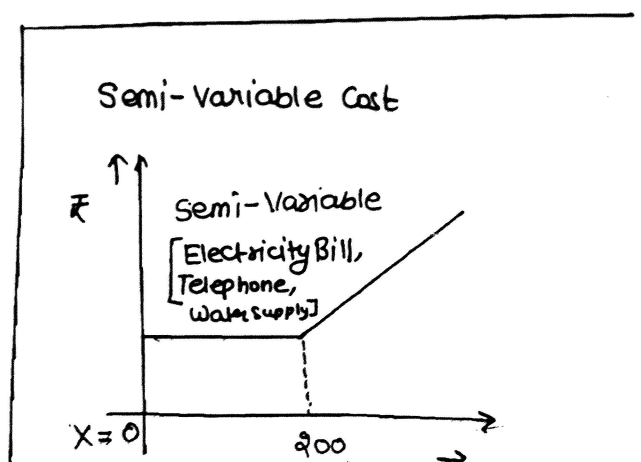
1. Total Cost → It indicates expenditure required in order to Produce certain number of unit and it is a Sum of Fixed and Variable cost



- Fixed Cost → this cost remains constant or fixed irrespective of Volume of Production. it include cost of Machine, equipment, Salary of Watchman, Higher officers, rent of Store Room, ware-house, Adversment Cost, Set-up Cost, insurance cost, interest etc
- Variable Cost → ($V = V \cdot x$)



This cost increases directly and Proportionally with the Volume of Production. it include direct material, direct labour and running cost.



• Notations →

F → Fixed cost in ₹

x → No. of units produced or Volume of Production

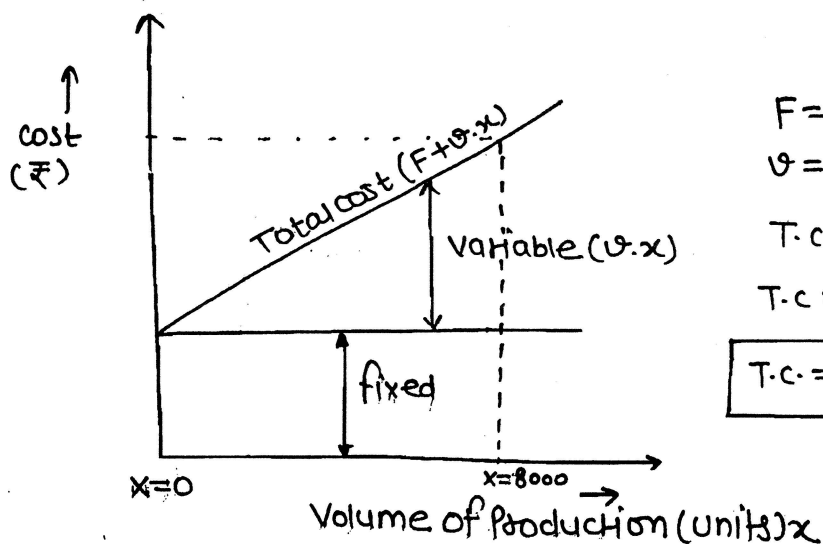
ϑ → Variable cost Per unit (₹/unit)

V → Total variable cost in ₹
 $\vartheta \cdot x$

s → Selling cost Per unit (₹/unit)

S → Total Sales or Revenue in ₹
 $s \cdot x$

• Total Cost : →



$$F = 25000 \text{ ₹}$$

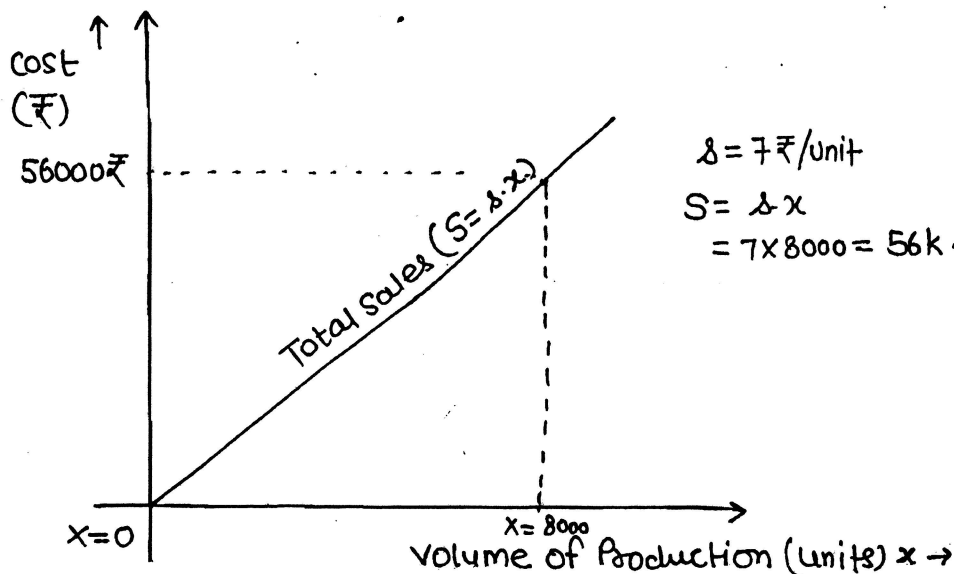
$$\vartheta = 3 \text{ ₹/unit}$$

$$T.C. = F + \vartheta \cdot x$$

$$T.C. = 25000 + 24000$$

$$T.C. = 49000 \text{ ₹}$$

• Total Sales ($S = s \cdot x$) : →



$$s = 7 \text{ ₹/unit}$$

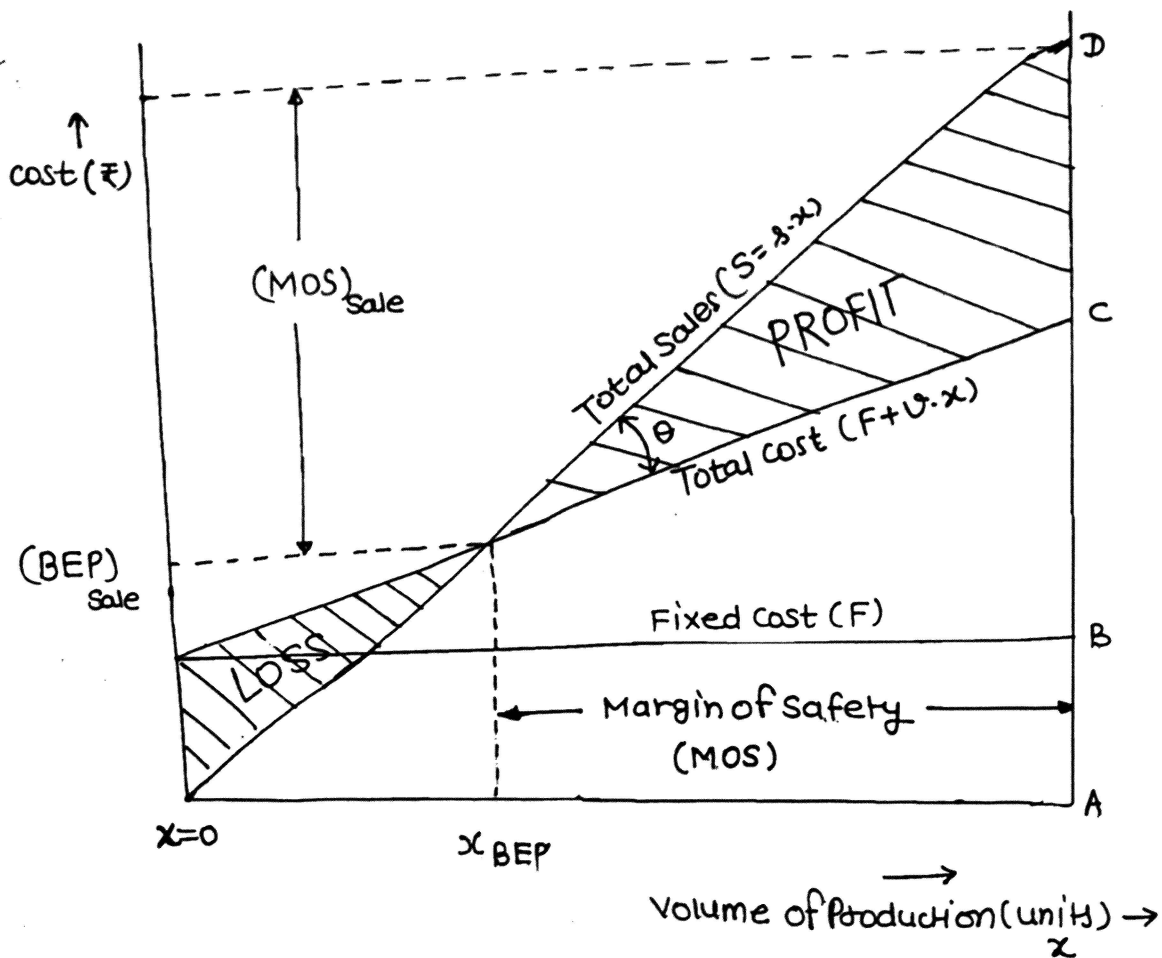
$$S = s \cdot x$$

$$= 7 \times 8000 = 56 \text{ k ₹}$$

It indicates the return obtained by selling out the quantity produced and it is directly proportional to volume of production

• Assumption:->

1. $F, V, S \rightarrow$ remains Constant
2. No defective Parts Produced
3. All Product Produced are sold out



Break Even Point is the Volume of Production where total cost is equal to total sales and organization neither earn profit nor suffer from loss. It is also known as No Profit No Loss Point.

$$\text{Total Sales} = \text{Total cost} + \text{Profit}$$

$$\text{Total cost} = F + V = F + V \cdot x$$

$$\text{Profit} = P$$

$$S = F + V + P$$

$$s \cdot x = F + V \cdot x + P$$

$$(s-v)x = F + P$$

$$x = \frac{F+P}{s-v} \quad \text{Units}^*$$

At BEP, $P=0$

$$x_{\text{BEP}} = \frac{F}{s-v} \quad \text{Units}^*$$

$$(BEP)_{\text{Sales}} = x_{\text{BEP}} \cdot s = \frac{F}{s-v} \cdot s \text{ ₹}$$

• Angle of Incidence (θ): →

It is an angle at which Total Sales Line Cut the Total Cost Line, Larger this angle better the working conditions will be

• Contribution Margin (CM): →

$$CM = S - V = (s-v)x \quad \text{Imp}$$

$$\text{Contribution} = (s-v)$$

$$[v = 6 \text{ ₹/unit}, s = 10 \text{ ₹/unit}, s-v = 4 \text{ ₹/unit}]$$

$$S = F + V + P$$

$$S - V = F + P$$

$$CM = F + P = (s-v)x$$

$$P = CM - F$$

CM → Marginal Profit

or

Gross Margin